Number of Printed Pages — 5 **EC-302**

B.TECH.

THIRD SEMESTER EXAMINATION, 2001-2002

SWITCHING THEORY & LOGIC DESIGN

Time—2 Hours *Total Marks—50*

Note : Answer *ALL* the questions.

1. Attempt any *Two* parts. All parts carry equal marks. 4×2

(*a*) Simplify the Boolean function F in Sum-of-product using the don't – care conditions d :

$F = B'C'D' + BCD' + ABCD'$

$d = B'CD' + ABC'D$

(*b*) Simplify the following Boolean function by means of the tabulation method :—

$F(A, B, C, D) = \sum(4,6,7,8,9,10,11,15)$

(*c*) The following Boolean Expression :

$BE + B'DE'$ is a simplified version of expression :—

$A'BE + BCDE + BC'D'E + A'B'DE' + B'C'DE'$.

Are there any don't-care conditions ? If so, what are they ?

2. Attempt any *Four* parts. All parts carry equal marks. $3\frac{1}{2} \times 4$

(*a*) (*i*) Find the decimal equivalent of the following binary numbers assuming signed magnitude representation of the binary number :—

(1) 001000

(2) 1111

(*ii*) Write the procedure for the subtraction of two numbers with $(r-1)$'s complement.

(*b*) Perform the subtraction with the following binary numbers using (1) 2's complement (2) 1's complement.

(*i*) 11010 – 1101

(*ii*) 10010 – 10011

(*c*) Perform the subtraction with following decimal numbers using (1) 10's complement (2) 9's complement.

(*i*) 5294 – 749

(*ii*) 27 – 289

(*d*) Implement the following function with a 4 × 1 multiplexer.

$$F(A, B, C) = \sum (1, 3, 5, 6)$$

(*e*) Implement a full-adder circuit with a 3 × 8 decoder and two *OR*-gates.

(*f*) What is Hazards ? How will you design a Hazard-free switching circuit ?

3. Attempt any *Four* parts. All parts carry equal marks. 3½ × 4

(*a*) How will you differentiate between combinational circuit and sequential circuit.
Consider a J–K′ flip-flop, i.e. a J–K flip-flop with an inverter between external input K′ and internal input K.

(*i*) Obtain the flip-flop characteristic table.

(*ii*) Obtain the characteristic equation.

(*b*) Prepare the truth-table for the circuit of fig-3b and show that it acts as a T-flip-flop.

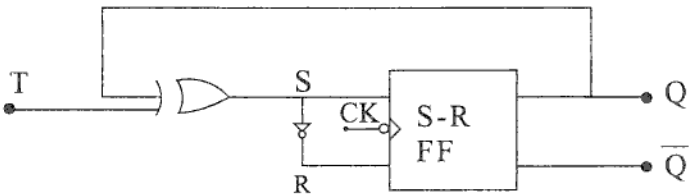

Figure-3b

(*c*) A mod-3 counter (reset after every three pulses) is shown in fig-3c. The flip-flops used are master-slave J-K. Sketch the waveform of Q_0 and Q_1 when clock pulses are applied and verify its operation. Assume $Q_0 = Q_1 = 0$ initially.

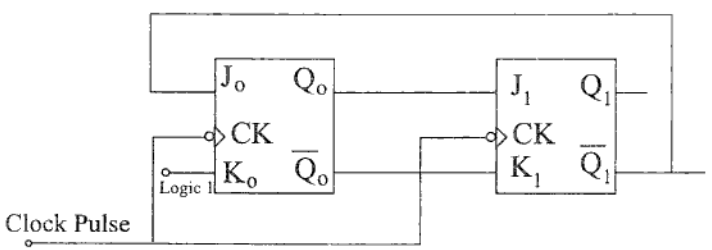

Figure-3c

(*d*) What is race-around condition ?

If $\overline{Q}$ output of a D-type flip-flop is connected to D-input, it acts as a toggle switch, verify.

(*e*) For the state diagram shown in figure-3e, obtain the state table and design the circuit using minimum number of J-K flip-flop.

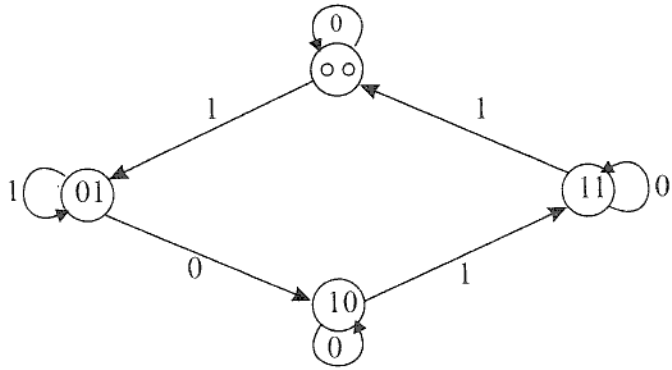

Figure-3e

(*f*) Design a 3-bit binary UP/DOWN counter with a direction control M. Use J-K flip-flop.

4. Attempt any *Four* parts. All parts carry equal marks. $3\frac{1}{2} \times 4$

(*a*) Explain the principle of constructing a Hamming error-correcting code. Construct a Seven-bit Hamming code for the 4-bit message 0100.

(*b*) Explain the floating-point data representation for decimal number and binary number. When is a floating point number said to be normalized ?

(*c*) What is the difference between asynchronous and synchronous circuits ? Represent the Octal number $(17{\cdot}32)_8$ into floating point Octal number and floating point binary number.

(*d*) Draw the basic model for fundamental mode circuits and explain.